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1 RECORD OF ORAL HEARING
2
3 UNITED STATES PATENT AND TRADEMARK OFFICE
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6 BEFORE THE BOARD OF PATENT APPEALS
7 AND INTERFERENCES
8
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10 Ex parte KWANG-JO HWANG
11
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13 Appeal 2008-0126
14 Application 09/648,111
15 Technology Center 2800
16
17

18 Oral Hearing Held: May 14, 2008
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21
22 Before KENNETH W. HAIRSTON, MAHSHID D. SAADAT, and
23 ROBERT E. NAPPI, Administrative Patent Judges.
24

25 ON BEHALF OF THE APPELLANT:
26

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32 The above-entitled matter came on for hearing on Wednesday, May
33 14, 2008, commencing at 9:00 a.m., at The U.S. Patent and Trademark
34 Office, 600 Dulany Street, Alexandria, Virginia, before Timothy J.
35 Atkinson, Jr., Notary Public.
36

1 MS. BOBO-ALLEN: Calendar No. 13, Appeal No. 2008-0126.

2 Mr. Webster.

3 JUDGE NAPPI: Okay. How you doing?

4 MR. WEBSTER: Good morning.

5 JUDGE NAPPI: Good morning.

6 MR. WEBSTER: How is everybody today? I take it you have all
7 read the -- all the papers. As it turns out, I'll -- I won't probably take the full
8 20 minutes today. I'll just run through the fundamentals, summarize the
9 invention, summarize the, the rejection and the points that we have --

10 JUDGE NAPPI: -- in rebuttal.

11 MR. WEBSTER: Okay, the applicant has four independent method of
12 making claims. Claim 1 is a combination method claim. Claims 22, 30, and
13 31 are sub-combination method claims. Claim 22 is the broadest, recites a
14 method of patterning a metal layer including depositing a metal layer on the
15 substrate, forming a mask on the surface of the metal layer, leaving an upper
16 portion of the metal layer uncovered, exposing the uncovered portion of the
17 metal layer to a first plasma prior to any step of etching the metal layer,
18 thereby lowering an internal binding force in the uncovered portion to
19 increase a subsequent etch rate of the metal layer and then etching the
20 uncovered portion of the metal layer with the second plasma to form a metal
21 pattern.

22 The reason that the applicant does this is that if the time it takes to
23 etch the metal layer is too long, then RF power that is being applied during
24 the entire process can harm the substrate and can harm the entire device, so
25 he wants to go ahead and speed things up.

Now the first group of claims -- the appellant has, has two different groups of claims. The first group of claims is directed typically to the, the broad independent claims and some of the dependent claims. The second group covers Claims 10, 17 through 19 and 25 through 27 and recites etching the metal layer with specific gas compositions, and the third group covers Claims 3, 4, 14 and 23 and recites using a reactive gas in general to lower a binding force and also recites a specific reactive gas.

The rejection of all independent claims relies on two references. The primary reference is Hirano which discloses a thin film, transistor switched, active matrix type liquid crystal display device. It has a pixel electrode 16, which is shown in figure 16, made of indium 10 oxide that is deposited on the overall surface of the device by sputtering. Now this is disclosed in step 14 in column 12 of Hirano. To work the indium 10 oxide film into a pixel electrode shape, a rhesus pattern is formed on the indium 10 oxide film 16 which is dry etched using two different gases. This is disclosed in step 15, column 12.

The final rejection admits that Hirano does not disclose the claimed invention. In an attempt to remedy the clear shortcomings of Hirano, the office action turns to Chen which also fails to disclose the claimed invention. Chen does absolutely nothing to speed up the etch rate of its deposited metal layers. In fact, in column 1, starting at line 32, Chen explicitly states that it provides a plasma treatment of its photo resist shape that slows the removal rate of the photo resist stage or shape while maintaining the desired removal rate of the metal layers. In other words, Chen specifically says that it does not speed up the etch rate of the metal layers. So Chen does not teach what is recited in the claim either.

1 Chen actually applies an insight to nitrogen plasma treatment to its
2 photo resist to produce a surface of its photo resist shape that "will be more
3 resistant to the subsequent main etch of its reactive ion etch procedure." He
4 has absolutely no concept whatsoever of speeding up the etch rate of the
5 exposed metal. The reason Chen does this is to allow and obtain narrow
6 photo resist forms as etch masks thereby allowing narrow shapes to be
7 formed in its thin photo resist layers. He does this to decrease the width of
8 the metal interconnect structures in semiconductor devices.

9 Now Chen's specific widths are disclosed of its interconnects in
10 column 3, lines 22 to 25, to be from 2,000 angstroms to 5,000 angstroms
11 wide. That's two-tenths of a micron to five-tenths of a micron wide.
12 Contrast that with Hirano's pixel electrode which is tremendously larger than
13 this. As disclosed in column 16, lines 23 through 29, Hirano's pixel pitch is
14 50 microns by 150 microns. So this means that Hirano's pixel electrodes are
15 hundreds of time larger than the extremely narrow interconnects that Chen is
16 directed to.

17 This significant difference between these two references teaches away
18 from combining them.

19 JUDGE NAPPI: Excuse me. Did you present that argument to the
20 Examiner?

21 MR. WEBSTER: No, I picked up the case last night.

22 JUDGE NAPPI: You are limited to arguments in the brief.

23 MR. WEBSTER: Okay. Now so what I'm saying is that -- although
24 this also, of course, is an argument along with the other ones that were
25 presented in the brief that teach away from combining these particular
26 references.

1 Now there also were some specific arguments that the Examiner had
2 that we rebutted, and rebuttal comments are on the record. One of the
3 statements that the Examiner says is that the positive limitation of treating
4 the exposed portion of the metal layer with the first plasma prior to any step
5 of etching the photo resist pattern, and prior to any step of etching the metal
6 layer, thereby lowering an internal binding force in the exposed portion of
7 the metal layer to increase a subsequent etch rate of the metal layer does not
8 have to be given patent able weight. The Examiner says this positively
9 recited limitation is merely an intended result.

10 Well, the Examiner I think is thinking about a device claim. This is
11 not a device claim. It's not an apparatus claim. It's a method claim, and the
12 method recites the function. So this has to be given patent able weight.

13 JUDGE NAPPI: Can, can you tell me the difference between your
14 plasma exposure and, and Chen's? It, it seems to me looking that reference
15 when Chen is exposing a photo resist, and I think it's 12C in this figure or
16 7A --

17 MR. WEBSTER: Right.

18 JUDGE NAPPI: In the figures that he is also exposing the metal
19 layers to meet the -- to the plasma?

20 MR. WEBSTER: He will, yes, he definitely will.

21 JUDGE NAPPI: Okay, so what's the difference between the plasma
22 exposure in Chen and the plasma exposure in yours?

23 MR. WEBSTER: Well, number one, he uses nitrogen.

24 JUDGE NAPPI: You don't use nitrogen?

25 MR. WEBSTER: We use hydrogen.

1 JUDGE NAPPI: You use hydrogen. Can you look at your
2 specification on page 6?

3 MR. WEBSTER: Yes. I don't have the spec here.

4 JUDGE NAPPI: I'll read it to you. It says "When using nonreactive
5 gas such as argon or nitrogen plasma gas, the binding force of the surface
6 metal becomes depressed physically."

7 MR. WEBSTER: Okay.

8 JUDGE NAPPI: So you use nitrogen, too?

9 MR. WEBSTER: It can be used as one but --

10 JUDGE NAPPI: Okay.

11 MR. WEBSTER: -- the, the desired one is hydrogen with the --

12 JUDGE NAPPI: Okay, but in the claims --

13 MR. WEBSTER: -- indium 10 oxide.

14 JUDGE NAPPI: The claims --

15 MR. WEBSTER: No, I realize the claims, right.

16 JUDGE NAPPI: The claims are broad enough to encompass
17 nitrogen?

18 MR. WEBSTER: Correct.

19 JUDGE NAPPI: So what is the difference between the plasma
20 process in Chen and the plasma process claimed?

21 MR. WEBSTER: The process claimed says treating the exposure
22 portion with the first plasma prior to any step of etching, thereby lowering
23 an internal binding force with the exposed portion of the metal layer.

24 JUDGE NAPPI: Okay, but your, your specification describes that this
25 process of, of exposing the, the nitrogen to the metal lowers the binding

1 force just by the presence of the, the nitrogen depressing physically on the
2 metal layer. Isn't that also going to happen in Chen?

3 MR. WEBSTER: I might. It might --

4 JUDGE NAPPI: If it works for you, won't it work for Chen?

5 MR. WEBSTER: -- not. The problem is the burden is on the
6 Examiner to show if it's an inherent process that it must necessarily occur.

7 JUDGE NAPPI: Well, according to your spec, it is an inherent
8 process.

9 MR. WEBSTER: No, it doesn't -- the specification does not say that.
10 It does not say this necessarily --

11 JUDGE NAPPI: Well, it --

12 MR. WEBSTER: -- will occur.

13 JUDGE NAPPI: What I want to understand is if it works for you,
14 why doesn't it work for Chen? Meaning if, if your process -- what is
15 different about your process than Chen's process that allows that lowering of
16 the binding force?

17 MR. WEBSTER: The process that we have -- the primary process
18 that we use, and it's stated in the specification at page 6, lines 16 through 21,
19 if hydrogen gas --

20 JUDGE NAPPI: You do have a copy of the --

21 MR. WEBSTER: Excuse me?

22 JUDGE NAPPI: You do have a copy of the spec?

23 MR. WEBSTER: I have, I have a copy of the brief that, that refers --

24 JUDGE NAPPI: Okay.

1 MR. WEBSTER: -- to the specification. If hydrogen gas reacts with
2 oxygen in an indium 10 oxide metal layer, water forms to leave only indium,
3 thus reducing the binding force.

4 JUDGE NAPPI: Okay.

5 MR. WEBSTER: Okay, now --

6 JUDGE NAPPI: If you keep reading though, it talks about you can
7 use nitrogen, and it's a nonreactive situation.

8 MR. WEBSTER: Right.

9 JUDGE NAPPI: And what I'm asking is the nonreactive situation that
10 is encompassed in your claim seems to be identical to the process in Chen. I
11 don't see any difference, and I'm asking you what the difference is.

12 MR. WEBSTER: Well, what I'm saying is you can't use the
13 appellant's disclosure against the appellant, and you have to take a look at
14 the prior art, and the prior art does not teach it. In fact, both of the
15 references teach away from doing that, especially when Chen says that you
16 keep the reaction rate at the metal layer the same. What you really want to
17 do is to harden the, the photo resist itself. That's the whole purpose of Chen.

18 JUDGE SAADAT: But the, the portion of Chen that you cited that
19 explains the plasma treatment actually slows down the removal of photo
20 resist --

21 MR. WEBSTER: Right.

22 JUDGE SAADAT: -- if you continue reading, the next sentence talks
23 about the increased etch rate selectively allows thinner photo resist shape.
24 What is that increase --

25 MR. WEBSTER: No, it's the increased etch rate ratio. What he is
26 interested in is --

1 JUDGE SAADAT: No, in column, column 1. I mean that's the
2 portion you cited. Column 1 --

3 MR. WEBSTER: All right, the abstract talks about an increased X
4 rate rating, X -- etch rate ratio.

5 JUDGE SAADAT: Of the metal. It's --

6 MR. WEBSTER: But it's the ratio of the etch rate --

7 JUDGE SAADAT: I don't see ratio.

8 MR. WEBSTER: -- of the photo resist -- it's clearly in the abstract.
9 The increased etch rate ratio.

10 JUDGE SAADAT: Column 1, lines 32 through 36.

11 MR. WEBSTER: Right, and what it says here is that the plasma
12 treatment of the photo resist shape slows the removal rate of the photo resist
13 shape in a specific etching while maintaining the desired removal rate of the
14 exposed metal. The increased etch rate selectivity allows thinner photo
15 resist shapes, and he is talking about the etch rate selectivity, and he clarifies
16 that. In the abstract, it says the increased etch rate ratio between layers used
17 for the interconnect structure and the plasma treated photo resist shape
18 allows the thinner photo resist shapes to be used.

19 So he is focusing on the ratio of the etch rate of the resist and the etch
20 rate of the metal layer, and he clearly says that he maintains the desired
21 removal rate of the exposed metal. He does not say that he speeds it up in
22 any way, shape or form.

23 JUDGE SAADAT: He may not have recognized what happens to the
24 metal when exposed to plasma, and your claim describes the increased etch
25 rate of the metal by the mechanism that you explained as lowering an
26 internal --

1 MR. WEBSTER: Right.

2 JUDGE SAADAT: -- binding force?

3 MR. WEBSTER: Right.

4 JUDGE SAADAT: That's not an action or a part of the process. It's
5 how that characteristic can be described in a microscopic level.

6 MR. WEBSTER: Well --

7 JUDGE SAADAT: What do you do with the plasma exposure that is
8 different from the plasma exposure in Chen that affects the metal and Chen's
9 plasma doesn't affect --

10 MR. WEBSTER: Well, as, as the -- as it says in the, the part of the
11 specification that I quoted --

12 JUDGE SAADAT: Hydrogen versus nitrogen?

13 MR. WEBSTER: The hydrogen gas reacts with oxygen in an ITO
14 metal layer. Water forms to leave only indium, thus reducing the binding
15 force.

16 JUDGE NAPPI: That, that doesn't answer the question with respect
17 to using nitrogen gas, though, which you also disclose you use.

18 MR. WEBSTER: Right. With respect to the nitrogen.

19 JUDGE NAPPI: So, so what I'm hearing you say is there is no
20 difference in the plasma -- the way the plasma is applied in Chen and the
21 way you apply it is the same. You are just claiming a different result from
22 using the plasma. That's all I'm hearing, because I have yet to hear you tell
23 me what the difference between your plasma treatment is.

24 MR. WEBSTER: Well, if, if your argument were followed, then you
25 would take any nitrogen type process, etching process, and say it means the
26 invention. You would even say that Hirano does that, and Hirano does not

1 do that. Hirano doesn't do that. Hirano can use standard dry etchants and,
2 and really never did that, and Chen clearly does not do that, and Chen does
3 not teach doing that, and the office has not come up and has not come up
4 with any objective evidence that it's really going to be the same or that one
5 of ordinary skills in the art at the time of the invention would appreciate it.

6 JUDGE NAPPI: If I go with that, tell me something. Where in your
7 spec have you enabled somebody? Where have you described how it is that
8 your nitrogen plasma operates to cause this effect whereas Chen's -- which
9 differentiates from Chen's process?

10 MR. WEBSTER: Well, when you get into issues of enablement,
11 which have not been raised in this proceeding --

12 JUDGE NAPPI: I'm trying to understand the scope of the claim. I'm
13 trying to understand how your invention is.

14 MR. WEBSTER: Right.

15 JUDGE NAPPI: I'm not raising the issue of enablement. I want to
16 understand how your, how your invention produces the result that you've
17 claimed.

18 MR. WEBSTER: Well --

19 JUDGE NAPPI: Because you're, you're differentiating your method
20 based upon the result, the result the method produces.

21 MR. WEBSTER: The result that it achieves.

22 JUDGE NAPPI: And I, I want to understand how that result -- and,
23 and I, I -- you keep focusing back down on the hydrogen and, and I'm
24 concerned with how it achieves the result with the nitrogen and how it does -
25 - and how that result is -- the process of achieving that result is different
26 from what --

1 MR. WEBSTER: Well, I -- all right. The applicant doesn't have to
2 explain how it works. He just has to explain that it does work, and he
3 explains that it does work and, and he shows that, you know, the, shows --
4 he shows how he did it. Chen -- if Chen got that result, and Chen was one of
5 ordinary skill in the art, Chen would have realized it. Chen makes
6 absolutely no disclosure of that whatsoever. None, none whatsoever.

7 So the only, the only thing that I can really say is applicant was the
8 only one who not only appreciated this but did put it in a claim because as --
9 from our perspective, that specific step of treating it, thereby lowering the
10 internal binding force, just isn't in, in any of the references.

11 JUDGE SAADAT: But it's not inconsistent with Chen, because even
12 if the ratio, the etch ratio is improved between --

13 MR. WEBSTER: Right.

14 JUDGE SAADAT: -- photo resist and the metal --

15 MR. WEBSTER: Right.

16 JUDGE SAADAT: -- even if the plasma, although not recognized by
17 Chen, increases the etch rate of metal, it still moves in the same direction so
18 the -- it's not teaching away, but they have attributed their improved device
19 or processing to the slower rate, etch rate of the photo resist. So what we are
20 grappling with is is the plasma also responsible for increased etch rate of the
21 metal in Chen? And based on your specification, it seems like the plasma
22 should also achieve that result.

23 MR. WEBSTER: That's assuming that it, it necessarily occurs and,
24 and I -- but the way I see your argument is you're saying well, it might
25 occur, and in fact, it may probably occur, but that doesn't mean that it
26 necessarily occurs.

1 JUDGE SAADAT: That's what --

2 MR. WEBSTER: No, and I --

3 JUDGE SAADAT: -- Judge Nappi is -- in the spec what is it --

4 JUDGE NAPPI: And, and I want to find out what the difference
5 between your process and Chen's process is so we can figure out whether or
6 not it does necessarily occur in Chen. What, what steps do you do that aren't
7 in Chen? What pressures, what volumes? What do you do that's different
8 than Chen?

9 MR. WEBSTER: Well --

10 JUDGE NAPPI: To say that we can't show that it necessarily does,
11 you know, you can't say that the Examiner necessarily shows -- well, that
12 may be true, but then the other side of the equation is we look at your spec
13 and say well, how do we know that it necessarily occurs -- what, what makes
14 it necessarily occur on your side?

15 MR. WEBSTER: Again, the applicant doesn't have to explain that,
16 and the Supreme Court has said that. You don't have to explain how it
17 works. You just have to explain that it works, and the fact that he does put
18 in here that it lowers the internal binding force of the exposed portion. Now
19 I know there's at least one embodiment in, in our disclosure that does that.
20 It's the hydrogen and the H₂O.

21 JUDGE SAADAT: But also you use nitrogen so that's the --

22 JUDGE NAPPI: Your claims are broad enough to use nitrogen.

23 MR. WEBSTER: They are.

24 JUDGE SAADAT: Even in the spec --

25 MR. WEBSTER: They are, they --

26 JUDGE SAADAT: -- in the description of figure 6 --

1 MR. WEBSTER: But there is no undue breadth rejection here. Well

2 --

3 JUDGE SAADAT: I'll point to the page number, page 6 of your spec
4 in description of figure 6A and 6B, which is on the method of manufacturing
5 of pixel according to the claim method, first metal is exposed to plasma, and
6 the paragraph following that says then the exposed surface of metal layer 44
7 is plasma treated by reactive gas such as H₂ plasma using photo resist pattern
8 36, also a nonreactive gas such as argon and nitrogen can be used. So the --

9 MR. WEBSTER: Yeah, but it doesn't say that they, they can be used
10 independently. It just says they can be used. You could also consider that to
11 be used in conjunction with.

12 JUDGE SAADAT: So --

13 JUDGE NAPPI: No, because down below the next couple of
14 sentences pretty clearly say when using nonreactive gas such as argon or
15 nitrogen the plasma gas, the binding force of the surface metal becomes
16 depressed physically. So your spec goes on to say that the, the argon and the
17 nitrogen --

18 MR. WEBSTER: Okay, does the same thing.

19 JUDGE NAPPI: Yeah.

20 JUDGE SAADAT: Yeah.

21 MR. WEBSTER: Okay.

22 JUDGE SAADAT: So based on that, just using nitrogen, plasma
23 would reduce metal --

24 MR. WEBSTER: It might.

25 JUDGE SAADAT: Well --

26 MR. WEBSTER: I mean for us it did, yeah.

1 JUDGE NAPPI: Well, well, let me say if, if given what you're saying
2 it might, then your spec is not enabling because you haven't, you haven't
3 show us it necessarily works. You know, that, that argument works both
4 ways for you.

5 MR. WEBSTER: Yeah.

6 JUDGE NAPPI: You know, if, if you're going to, if you're going to
7 rely on it to differentiate from the art, then, then we can use it against you as
8 -- in an enablement issue.

9 MR. WEBSTER: Okay. What about the claims that recite hydrogen?

10 JUDGE NAPPI: Have you argued them?

11 MR. WEBSTER: Yes.

12 JUDGE NAPPI: Where?

13 MR. WEBSTER: That's one of the three things that we have argued,
14 the grounds rejection to be reviewed on appeal. The third issue presented
15 for review is whether the combination of Hirano, Chen and further review of
16 Miraguchi (phonetic sp.) suggests all the elements of 3, 4, 14, and 23.

17 JUDGE NAPPI: Yeah, and all you say is however, the teachings of
18 Miraguchi fail to address the deficiencies of the previously discussed in
19 Hirano and Chen.

20 MR. WEBSTER: Well, as, as a practical matter, Miraguchi is direct
21 to a Schottkly device. We don't even have a Schottkly barrier here. I mean
22 it's, it's incredible that it was brought in. But he uses hydrogen for a
23 completely different purpose. I mean a Schottkly device is probably a
24 latching device. You know, it's a completely different type device, and he's
25 going to vary the characteristics of the Schottkly barrier. That really has
26 nothing to do with this. Again, that was not in a brief. I, I realize that.

1 The, the other -- perhaps the strongest argument with respect to the
2 nitrogen is one of ordinary skill in the art would not be motivated, would not
3 have any reasonable incentive, to modify Hirano in view of Chen in the first
4 place, because they are so disparate and are directed to such different things,
5 and that's basically the arguments that I was presenting earlier. They're,
6 they're just not -- they, they just teach a weight. Chen is only limited to
7 narrow interconnects and with the specific characteristic of a resist that's
8 very narrow, and you just don't have those -- just don't have that situation in
9 the pixel electrodes of Hirano. Hirano has got a huge pixel electrode. He
10 just doesn't need that process, and one of ordinary skill in the art wouldn't
11 go to the additional trouble of going ahead and doing that.

12 So the, the primary position that we have is that one of ordinary skill
13 in the art does not have any reasonably -- reasonable incentive to modify
14 Hirano's pixel electrode forming process to include Chen's significantly
15 different narrow metal interconnect process, and even if they were
16 combined, I think that both, both references teach away, because Chen
17 teaches that he maintains a normal etch rate of his metal layers. There's just
18 no appreciation of the invention there at all and, and I contend that the
19 invention is positively recited and it isn't.

20 JUDGE NAPPI: Okay. Any other questions?

21 JUDGE HAIRSTON: Thank you.

22 JUDGE SAADAT: Thank you.

23 (Whereupon, the hearing concluded on May 14, 2008.)